(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 March 2003 (13.03.2003)

PCT

(10) International Publication Number
WO 03/021096 A1

(51) International Patent Classification[7]: F02B 77/11, 77/13, G10K 11/168, B60R 13/08

(21) International Application Number: PCT/EP02/09830

(22) International Filing Date:
3 September 2002 (03.09.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

101 43 167.8	4 September 2001 (04.09.2001)	DE
60/318,360	12 September 2001 (12.09.2001)	US

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 03/021096 A1

(54) Title: HEAT-INSULATING AND SOUND-ABSORBING LINING FOR THE ENGINE COMPARTMENT OF MOTOR VEHICLES

(57) Abstract: The present invention relates to a heat-insulating and sound-absorbing lining for the engine compartment of, for example, moto vehicles, and to a method for the preparation thereof. The heat-insulating and sound-absorbing lining for the engine compartment of motor vehicles consists of a microperforated heat reflector (1) on the engine side, in contact therewith a polyurethane foam layer (2) impregnated on the engine side with a thermoset material having a long-term temperature resistance of 200°C, especially 150°C, for three weeks, and in contact therewith a cover layer (3) facing away from the engine side.

Heat-Insulating and Sound-Absorbing Lining for the Engine Compartment of Motor Vehicles

The present invention relates to a heat-insulating and sound-absorbing lining for the engine compartment of, for example, motor vehicles, and to a method for the preparation thereof.

In the engine compartment of modern vehicles, in both passenger and utility fields, sound-absorbing parts in the form of absorbers are increasingly employed for reducing engine noise. These absorbers, which are predominantly designed as formed parts, have an influence on the exterior and interior noise of the vehicles. In the region of, for example, exhaust manifolds or exhaust gas recirculation systems, these parts are subject to a higher thermal load. The formed parts predominantly employed today which are made of non-woven fabrics (e.g., of cotton) or of PU foam typically have deflection temperatures under load of up to about 160 °C. For higher thermal loads, these formed parts are partially or completely backed with aluminum foils as heat reflectors on the surface facing the heat source in order to protect the non-woven fabrics lying behind.

Thus, it is known to protect installed parts in particularly heat-loaded zones by backing with aluminum foils. Such installed parts are known from DE-U-87 00 919. However, this has a drawback in that the sound-

absorbing effect of the installed part under the aluminum backing is lost since the sound cannot penetrate the aluminum foils.

From DE 36 01 204 A, an absorptive formed part consisting of several layers of non-woven is known which may serve for noise-damping linings for the engine compartment of motor vehicles. The absorptive formed part consists of a cover layer of plastic fibers on the engine side, a contiguous heat-insulating and sound-absorbing layer of inorganic fibrous material having a high deflection temperature, and another absorbing layer of organic fibers.

DE 38 18 301 C also describes a noise-damping formed part for the engine compartment of motor vehicles in which an inorganic fibrous material bonded by a binder and having a high deflection temperature is covered, on the engine side, with a carbon fibrous material through a bonding agent containing a melamine resin. This formed part is said to have a good sound absorption and to be also suitable as a thermal insulation in a temperature range of up to about 500 °C. It is further intended that the formed part is provided with a layer of carbon fibers towards the body. This carbon fibrous layer is said to provide some mechanical protection for a sensitive layer of inorganic fibrous material.

DE 42 11 409 A1 relates to a self-supporting, heat-insulating and sound-absorbing lining for combustion engines of motor vehicles which consists of several layers compression-molded under the action of pressure and heat to form zones having a predefined compression. On the engine side, the lining consists of a thicker heat-insulating and sound-absorbing layer of an inorganic fibrous material which is covered by a carbon fibrous material. A thicker layer of inorganic fibrous material facing away from the engine will cure into a self-supporting support layer. On the body

side, this support layer be covered with a layer of a polyester non-woven or polyacrylonitrile fibers.

A heat-insulating and sound-absorbing lining which is also often employed in the automobile field is based on melamine resin foams to which temperature-resistant cover layers are applied on one or both sides. According to DIN 4102, melamine resin foams are considered flame-resistant, and due to their behavior in fire, are to be classified into class B1. Due to its long-term thermal stability of –40 °C to 150 °C and its long-term temperature resistance of 200 °C for three weeks, this material is particularly suitable for preparing linings for the engine compartment of motor vehicles.

WO 99/58833 relates to a heat-insulating and sound-absorbing lining for the engine compartment of motor vehicles, and a method for its preparation. The lining consists of a cover layer 1 on the engine side, and in contact therewith an acoustically insulating thermoset foam layer 2 having a long-term thermal stability of up to 180 °C and a long-term temperature resistance of 200 °C for three weeks, of a thickness of less than 5 mm, and in contact therewith an acoustically insulating layer 3 of plastic foam, particle composite foam or non-woven fabric, consisting of native or synthetic fibers and mixtures thereof, needled or not, and in contact therewith a cover layer 4 facing away from the engine side.

However, the above structure is extraordinarily expensive so that it has been the object of the present invention to provide linings for the engine compartment of motor vehicles which are comparable therewith regarding the heat insulation and sound absorption, but involving a significant reduction in costs as compared to the prior art.

In a first embodiment, the above object is achieved by linings for the engine compartment of motor vehicles, consisting of a microperforated heat reflector 1 on the engine side, in contact therewith a polyurethane foam layer 2 impregnated on the engine side with a thermoset material having a long-term temperature resistance of 200 °C, especially 150 °C, for three weeks, and in contact with said foam layer 2, a cover layer 3 facing away from the engine side. The thermoset material can be directly applied to the component part as a dispersion or powder, or prepared from the corresponding monomers "in situ" on the component part by a cross-linking reaction.

Thus, the lining parts according to the invention are particularly suitable for the lining of installed parts, body parts or the like of automobiles, heat-emitting machines and aggregates, especially sound-absorbing elements, for the protection against too high thermal loads from machine guides, catalytic converter parts or the like, especially in the engine compartment of motor vehicles.

The core idea of the present invention has been to partly replace the relatively expensive thermoset foam material of foam layer 2 having an integral structure by less expensive materials without adversely affecting the heat-insulating and sound-absorbing properties. Also, of course, a deterioration of the thermal behavior is not acceptable. Thus, the lining parts according to the invention have an improved capability of reducing the noise produced on and in the vehicle. For example, a corresponding sound-insulating front access door can reduce sound transmission through the front access door. The geometry of the lining part depends on the interior side of the front access door and the space conditions in the engine compartment. The lining parts are attached, for example, by engaging them into a hole pattern in the interior zone of the front access

door. They are held by as few spreading rivets as possible. In the region of the bulkheads within the engine compartment, it is possible, according to the invention, to apply lining parts between the body and the engine, the lining parts preferably being attached to the body using coarse thread bolts or snap fasteners (or sheet metal nuts).

The lining parts serve for sound absorption of the engine noise. For this component part, the thermal conditions, above all in the region of an engine-near catalytic converter, are to be observed.

In the region of the wheel housing in the engine compartment, the lining parts according to the invention on the engine side are positioned, for example, in the air collection space. They prevent engine noise from intruding into the interior space and are preferably also attached with coarse thread bolts or snap fasteners. In the region of the bulkhead of the engine compartment, the lining parts according to the invention serve, for example, for covering the body-in-white from the cross member bulkhead or disk gap to the level of the tunnel for completing the underside paneling. Optionally, the lining parts may contain openings for ducts of the air conditioning system. In the region of the tunnel exterior, the lining parts according to the invention may also be inserted between the transmission or the exhaust gas train and the floor pan. In this case too, it is particularly preferred according to the invention to attach them with coarse thread bolts and/or snap fasteners, for example, sheet metal nuts.

When the lining parts according to the invention are employed in the region above the clean-air panel, it is covered from above and is then attached there. It is then positioned above the left and right bulkheads of the engine compartment.

There is no drop of strength below the initial value by the action of heat when used as directed.

The maximum allowable temperature of the lining parts on the engine side, facing away from the sheet, is at least on the same order of magnitude as that of lining parts which exclusively consist of melamine resin layers backed on one or both sides, and even at a higher temperature due to the presence of the heat reflector.

The heat reflector 1 on the engine side consists, for example, partially or throughout of a metal foil in the region of increased thermal load. For absorbers known in the prior art, a layer thickness of the aluminum foil of 250 µm or more is usually chosen. Accordingly, it is also possible according to the present invention to employ aluminum foils with a layer thickness in the range of from 50 to 500 µm. However, it is particularly preferred according to the present invention to employ aluminum foils with a layer thickness in the range of from 50 to 100 µm. Such a low layer thickness can be used because the remaining components of the laminate according to the invention are also capable of serving static functions.

Due to the microperforation of the heat reflector 1, on the one hand, the function as a heat reflector is retained, but on the other hand, permeability to sound waves is achieved in this region so that the thermoset materials on the side of the heat reflector 1 facing towards the sound source including the PUR foam remain acoustically effective.

Therefore, it is particularly preferred according to the invention to use linings in the vehicle field which are characterized in that the heat reflector 1 has a proportion of perforated area with microperforations of from 0.2 to 4%, especially 0.3 to 2%, based on the surface area of the

foil. Of course, it is possible to provide them with different or equal proportions of perforated area. The perforations can be made in the microperforated foil in any geometry by methods per se known in the prior art, for example, by punching or laser irradiation.

If the proportion of perforated area is selected too low, a sound-absorbing effect is not provided, or only insufficiently so, while on the other hand, when the proportion of perforated area is selected too high, the sound-absorbing effect is again decreasing.

Preferably, the linings in the vehicle field according to the invention comprise perforations in the heat reflector 1 having one or more diameters within a range of from 0.05 mm to 2 mm, especially from 0.1 mm to 0.8 mm, and one or more perforation spacings within a range of from 1 mm to 3 mm, especially from 2 mm to 20 mm.

It is particularly preferred according to the present invention when the foam layer 2 consists of a flexible open-cell foam of polyurethane with a bulk density of, for example, 15 kg/m^3 ± 1.5 kg/m^3.

From the three-dimensional structure and the starting product, an attractive property profile results which is characterized by the following properties:

- a high sound-absorbing capacity;
- long-term temperature resistance: 200 °C
- behavior in fire: B1 according to DIN 4102
- bulk density: 10 kg/m^3 ± 1.5 kg/m^3
- thermal conductivity "lambda"$_{10}$ ≤ 0.035 W/mK
- high flexibility
- shaping by molding and cutting

- easy processing
- low-cost preparation.

The PU material is usually supplied in a block form to the processor who can prepare formed parts for a wide variety of applications by cutting and molding. From the versatile property profile, a broad range of applications result. The actual advantages of the product result from a combination of different properties.

Optionally, layer 2 may have a grid-type profile, especially on the interface with the decorative layer 3. The profile is preferably made from one side; it may consist, for example, of convex projections on one side represented as cones or pyramids. By a material- and cost-saving "nap cutting technique", excellent acoustic values can be achieved through a hollow chamber principle.

Of course, heat transmission values and acoustic properties can be extensively controlled by the thickness of the layers.

Preferably, the lining is characterized in that the foam layer (2), in the impregnated state, has a basis weight of from 50 to 1500 g/m^2, especially from 200 to 1000 g/m^2.

Preferably, the lining is characterized in that the foam layer (2), in the impregnated state after curing of the thermosetting material, has a basis weight of from 30 to 1200 g/m^2, especially from 150 to 800 g/m^2.

Preferably, the lining is characterized in that the foam layer (2) has a flow resistance according to DIN of from 200 to 10,000 Ns/m^3, especially from 500 to 5000 Ns/m^3.

Preferably, the lining is characterized in that the layer thickness of foam layer (2) is up to 20 mm, especially up to 10 mm.

The cover layer 3 serves to protect from mechanical damage. It is particularly preferred to employ, for example, a thin needled non-woven fabric or spun-bonded fabric to protect the mold from soiling. The layer thickness should preferably be from 30 to 200 g/m^2. The layer thickness of the respective layers can be varied widely depending on requirements. Thus, it is particularly preferred according to the present invention that the layer thickness of the textile fabrics is from 0.5 to 1.5 mm. In addition, it is particularly preferred that the textile fabric has a basis weight of from 30 to 200 g/m^2. The textile fabric serves especially as a mechanical protection for the foam layer 2, which is known to have a low strength. The oleophobic and hydrophobic character of the fibers protects the further layers present in the lining.

Preferably, the lining is characterized in that layers (2) and (3) are interconnected by an adhesive layer.

The formed parts according to the invention are preferably employed in the region of the bulkhead of engine compartments or in the region of the transmission tunnel of motor vehicles.

The formed parts according to the invention are prepared as usual by a thermoforming process so that tools and production means per se known in the prior art can be further employed for a given material conversion.

It is particularly preferred according to the present invention to prepare the linings by:

a) coating a thermosetting material in the form of a dispersion onto one side of a polyurethane foam board using a doctor blade, roll, foam or in a reverse process while the foam board is upset by the coating tool;

b) drying the semi-finished product obtained in step a) at least partially or completely with evaporation of water;

c) laying the cover layer 3 on top of the uncoated surface of foam layer 2;

d) contacting the semi-finished product obtained in step c) with a preform of the heat reflector 1; and

e) bonding foam layer 2 with the heat reflector 1 and the cover layer 3 by heating, cross-linking and adhesive bonding, optionally under pressure, in one step or in several steps, and curing the thermosetting material.

Examples:

A 20 mm thick panel of semi-rigid PU foam material having a basis weight of about 300 g/m^2 was coated with a mixture of 200 g of water and 200 g of melamine resin (Madurit®) per square meter using a doctor blade and with application of a slight pressure. The melamine resin penetrated into the PU foam layer to about 3 to 5 mm.

In another step, the coated foam material was dried at a temperature of about 80 to 100 °C. Then, in the subsequent compressing process, the thermosetting material cross-linked at an elevated temperature.

A commercially available adhesive was applied to the uncoated side of the foam material at about 60 g/m^2. Then, a cover layer of PES was applied at a basis weight of about 120 g/m^2. The thus obtained semi-finished product was laminated with a microperforated aluminum foil having a thickness of 0.15 mm and a proportion of perforated area of 0.36% and an average perforation diameter of 0.35 mm in a three-dimensional mold under increased pressure (press with 80 t of locking force; 120 s) and at an elevated temperature (190 °C) to yield a molded part, whereby the above mentioned layer thickness values could be achieved.

It was found that the thus prepared layer structure could withstand a thermal load of 200 °C, comparable with a thermal load from the engine side of the same temperature, for more than 3 weeks with no discernible changes.

CLAIMS:

1. A heat-insulating and sound-absorbing lining for the engine compartment of motor vehicles, consisting of a microperforated heat reflector (1) on the engine side, in contact therewith a polyurethane foam layer (2) impregnated on the engine side with a thermoset material having a long-term temperature resistance of 200 °C, especially 150 °C, for three weeks, and in contact therewith a cover layer (3) facing away from the engine side.

2. The lining according to claim 1, characterized in that the heat reflector (1) has a layer thickness of from 0.1 to 0.5 mm, especially from 0.2 to 0.4 mm.

3. The lining according to claim 1 or 2, characterized in that the heat reflector (1) has a proportion of perforated area of from 0.2 to 4%, especially 0.3 to 2%, based on the surface area of the absorber.

4. The lining according to claim 1 or 2, characterized in that the microperforations of the heat reflector (1) have one or more diameters within a range of from 0.05 mm to 2 mm, especially from 0.1 mm to 0.8 mm, and one or more perforation spacings within a range of from 1 mm to 3 mm.

5. The lining according to claim 1 or 2, characterized in that the heat reflector (1) has a proportion of perforated area with microperforation of from 0.2 to 4% and optionally a proportion of perforated area with macroperforation of from 2 to 20%, based on the surface area of the foil.

6. The lining according to claim 1 or 2, characterized in that the perforations of the microperforation are homogeneously distributed over the surface of the heat reflector (1), or concentrated on one or more sites of the heat reflector (1) with equal diameters of the perforations and equal open surface areas.

7. The lining according to any of claims 1 to 6, characterized in that the heat reflector (1) comprises a microperforated aluminum foil.

8. The lining according to claim 1, characterized in that the foam layer (2), in the impregnated state, has a basis weight of from 50 to 1500 g/m^2, especially from 200 to 1000 g/m^2.

9. The lining according to claim 1, characterized in that the foam layer (2), in the impregnated state after curing of the thermosetting material, has a basis weight of from 30 to 1200 g/m^2, especially from 150 to 800 g/m^2.

10. The lining according to claim 1, characterized in that the foam layer (2) has a flow resistance according to DIN of from 200 to 10,000 Ns/m^3, especially from 500 to 5000 Ns/m^3.

11. The lining according to claim 1, characterized in that the layer thickness of foam layer (2) is up to 20 mm, especially up to 10 mm.

12. The lining according to claim 1, characterized in that the cover layer (3) consists of a PES non-woven fabric, a glass-fiber non-woven fabric, a carbon non-woven fabric, a ceramic non-woven fabric and/or a mineral fiber non-woven fabric.

13. The lining according to claim 1, characterized in that the cover layer (3) consists of a needled non-woven fabric or spun-bonded fabric, especially with a basis weight of from 30 to 200 g/m^2.

14. The lining according to any of claims 1 to 13, characterized in that the layers (2) and (3) are interconnected through an adhesive layer.

15. A method for the preparation of linings as defined in any of claims 1 to 14, characterized by:

a) coating a thermosetting material in the form of a dispersion onto one side of a polyurethane foam board using a doctor blade, roll, foam or in a reverse process while the foam board is upset by the coating tool;

b) drying the semi-finished product obtained in step a) at least partially or completely with evaporation of water;

c) laying the cover layer (3) on top of the uncoated surface of foam layer (2);

d) contacting the semi-finished product obtained in step c) with a preform of the heat reflector (1); and

e) bonding foam layer (2) with the heat reflector (1) and the cover layer (3) by heating, cross-linking and adhesive bonding, optionally under pressure, in one step or in several steps, and curing the thermosetting material.

16. Use of linings as defined in any of claims 1 to 14 in the region of the bulkhead of engine compartments or in the region of the transmission tunnel of motor vehicles.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/09830

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F02B77/11 F02B77/13 G10K11/168 B60R13/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F02B G10K B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 01 12470 A (CHUONG DINH QUYEN ;FUCHS HELMUT V (DE); NICOLAI NORBERT (DE); CLIO) 22 February 2001 (2001-02-22) figures 1-3 abstract	1-5
A	claims 1-15 page 9, line 22 - line 31 page 10, line 1 - line 2 page 10, line 9 - line 14	6,7;11, 12,15,16
Y	US 5 807 628 A (MARSH DAVID S ET AL) 15 September 1998 (1998-09-15) figures 1,2 abstract column 2, line 21 - line 32 column 3, line 38 - line 59 claims 1-5	1-5

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 November 2002	15/11/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Wassenaar, G

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/09830

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 197 20 537 A (HP CHEMIE PELZER RES & DEV) 19 November 1998 (1998-11-19) abstract claims 1-14	1,2,12, 13,15,16
A	EP 0 557 597 A (REX PATENT) 1 September 1993 (1993-09-01) figure 1 abstract claims 1-10	1,7,12, 16
A	US 5 241 512 A (ARGY GILLES ET AL) 31 August 1993 (1993-08-31) figures 1-3 abstract column 5, line 21 - line 63 claims 1-20	1,2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 02/09830

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0112470 A	22-02-2001	DE 10022902 A1	08-03-2001
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DERWENT-ACC-NO: 2003-354488

DERWENT-WEEK: 200452

TITLE: Heat-insulating and sound-absorbing lining for engine compartment of motor vehicles, has microperforated heat reflector in contact with polyurethane foam layer on engine side and cover layer facing away from engine side

INVENTOR: ENKLER M; ENKLER M F

PATENT-ASSIGNEE: HP-CHEM PELZER RES & DEV LTD[HPCHN]

PRIORITY-DATA: 2001US-318360P (September 12, 2001) , 2001DE-1043167 (September 4, 2001)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE
WO 03021096 A1	March 13, 2003	EN
DE 10143167 A1	March 27, 2003	DE
AU 2002333791 A1	March 18, 2003	EN

DESIGNATED-STATES: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ OM PH PL PT RO RU SD SE S G SI SK SL TJ TM TN TR TT TZ UA UG US UZ VC VN YU ZA ZM ZW AT BE BG CH CY CZ DE DK EA EE ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SK SL SZ TR TZ UG ZM ZW

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
WO2003021096A1	N/A	2002WO-EP09830	September 3, 2002
DE 10143167A1	N/A	2001DE-1043167	September 4, 2001
AU2002333791A1	Based on	2002AU-333791	September 3, 2002

INT-CL-CURRENT:

TYPE	IPC DATE
CIPS	B32B5/18 20060101
CIPS	F02B77/11 20060101
CIPS	F02B77/13 20060101
CIPS	G10K11/168 20060101

ABSTRACTED-PUB-NO: WO 03021096 A1

BASIC-ABSTRACT:

NOVELTY - A heat-insulating and sound-absorbing engine compartment lining consists of microperforated heat reflector in contact with a polyurethane foam layer which is impregnated with thermoset material on engine side and provided with cover layer facing away from engine side. The thermoset material has long-term temperature resistance of 200 degrees C (preferably 150 degrees C) for three weeks.

DESCRIPTION - An INDEPENDENT CLAIM is also included for making of lining by coating a thermosetting material in the form of dispersion on one side of polyurethane foam board using a doctor blade, roll, foam, or in a reverse process while the foam board is upset by the coating

tool; drying the semi-finished product with evaporation of water; laying a cover layer on top of the uncoated surface of foam layer; contacting the semi-finished product with a pre-form of heat reflector; and bonding the foam layer with the heat reflector and cover layer by heating, cross-linking and adhesive bonding , optionally under pressure, and curing the thermosetting material.

USE - For use in the region of the bulkhead of engine compartment or in the region of the transmission tunnel of motor vehicles (claimed).

ADVANTAGE - The lining can withstand a thermal load of 200 degrees C for more than 3 weeks with no discernible changes. It exhibits high sound-absorbing capacity and high flexibility. It can be easily manufactured at low cost.

EQUIVALENT-ABSTRACTS:

MECHANICAL ENGINEERING

Preferred Components: The foam and cover layers are interconnected through an adhesive layer. The microperforations of heat reflector have diameter of 0.05-2 (preferably 0.1-0.8) mm, and perforation spacing of 1-3 mm. The perforations are homogeneously distributed over the heat reflector surface, or concentrated on at least one heat reflector site with equal perforation diameter and equal open surface areas.

Preferred Dimensions: The heat reflector has a thickness of 0.1-0.5 (preferably 0.2-0.4) mm. The foam layer has a thickness of up to 20 (preferably up to 10) mm. The heat reflector has a proportion of perforated area of 0.2-4% (preferably approximately 0.3-2%) and optionally a proportion of perforated area with microperforation of 2-20%.

Preferred Properties: In impregnated state, the foam

layer has a basis weight of 50-1500 (preferably 200-1000) g/m2. After curing of thermosetting material, the foam layer has a basis weight of 30-1200 (preferably 150-800) g/m2. The foam layer has a flow resistance of 200-10000 (preferably 500-5000) Ns/m3 according to DIN.

TEXTILES AND PAPER

Preferred Materials: The cover layer comprises polyethylene sulfide non-woven fabric, glass-fiber non-woven fabric, carbon non-woven fabric, ceramic non-woven fabric and/or mineral fiber non-woven fabric, or preferably non-woven or spun-bonded fabric having a basis weight of 30-200 g/m2.

TITLE-TERMS: HEAT INSULATE SOUND ABSORB LINING ENGINE COMPARTMENT MOTOR VEHICLE REFLECT CONTACT POLYURETHANE FOAM LAYER SIDE COVER FACE

DERWENT-CLASS: A95 P86 Q17 Q52

CPI-CODES: A11-B05D; A11-C01C; A11-C02C; A12-S02F; A12-T04B;

ENHANCED-POLYMER-INDEXING: Polymer Index [1.1] 018 ; P1592*R F77 D01; S9999 S1309*R;

Polymer Index [1.2] 018 ; ND01; Q9999 Q7830; Q9999 Q9143; B9999 B5549 B5505; B9999 B3985 B3974 B3963 B3930 B3838 B3747; Q9999 Q9234 Q9212; Q9999 Q9289 Q9212; K9416; K9574 K9483; K9676*R;

Polymer Index [2.1] 018 ; H0328; L9999 L2391; L9999 L2073; M9999 M2073;

Polymer Index [2.2] 018 ; ND01; Q9999 Q7830; Q9999 Q9143; B9999 B5549 B5505; B9999 B3985 B3974 B3963 B3930 B3838 B3747; Q9999 Q9234 Q9212; Q9999 Q9289 Q9212; K9416; K9574 K9483; K9676*R;

Polymer Index [2.3] 018 ; Q9999 Q7114*R;

SECONDARY-ACC-NO:

CPI Secondary Accession Numbers: 2003-093391

Non-CPI Secondary Accession Numbers: 2003-283279